MEMORANDUM OF UNDERSTANDING FOR THE 2008 MESON TEST BEAM PROGRAM

T984

PHENIX VTX Prototype

15 July, 2008

INTRODUCTION

This is a Memorandum of Understanding (MOU) between the Fermi National Accelerator Laboratory and experimenters from the PHENIX experiment who have committed to participate in beam tests to be carried out during the 2008 MTest program.

This memorandum is intended solely for the purpose of providing a work allocation for Fermi National Accelerator Laboratory and the participating universities and institutions. It reflects an arrangement that is currently satisfactory to the parties involved. It is recognized, however, that changing circumstances of the evolving research program may necessitate revisions. The parties agree to negotiate amendments to this memorandum to reflect such revisions.

Description of detector and tests

The VTX is a silicon tracker upgrade for the PHENIX experiment to provide high resolution tracking over a large coverage in both rapidity and azimuthal angle. The VTX will enhance the physics capabilities of the PHENIX central arm spectrometers by providing precision measurements of heavy-quark production in *A+A*, *p(D)+A* and polarized *p+p* collisions .

The proposed VTX detector has four tracking layers. The inner two layers are based on silicon pixel device developed for the ALICE experiment at CERN's LHC accelerator. The basic detector element of the pixel system is the pixel ½ ladder. Each ½ ladder consists of 2 sensor modules each having 4 readout chips mounted on pixel bus. The read out of each ½ ladder is controlled by the Silicon Pixel Intermediate Read-Out (SPIRO) module which is connected to the ½ ladder by means of a bus extender. The outer two layers are based on a novel stripixel sensor developed by the Instrumentation Division at BNL and SVX4 silicon readout chip developed at FNAL. The basic detector module for the strip ladders is the stripixel module. Each module consists of a stripixel sensor and readout card (ROC). Each sensor is 3.46 x 6.36 cm^2 with 2x384 X-strips of 80 μm width and 3.1cm length and the same number of U-strips at an angle of 4.6^0 with respect to the X-strips. The sensor is mounted on the ROC, with SVX4 readout chips mounted along each side of the sensor. Readout of the SVX4s is controlled by the Readout Control Chip (RCC) module.

The experimenters propose to use 120GeV protons from the Fermilab test beam to measure the efficiency, charge sharing and noise performance of the pixel ½ ladders and stripixel sensor modules. This will provide important information for the simulation and construction of the full VTX detector.

I. PERSONNEL AND INSTITUTIONS:

Spokesman and physicist in charge of beam tests: Eric Mannel

Fermilab liaison: Erik Ramberg

The group members at present and others interested in the test beam are:

Brookhaven National Laboratory: R. Nouicer, A, Sukhanov
Columbia University: E.J. Mannel
Iowa State University: A. Dion, H. Pei
Oak Ridge National Laboratory: V. Cianciolo, A. Enokizono
RIKEN: K. Fujiwara, A. Taketani
Rikkyo: K. Hashimoto, M. Kasai
Stony Brook University: N. Apadula

II. EXPERIMENTAL AREA, BEAMS AND SCHEDULE CONSIDERATIONS

2.1 LOCATION

2.1.1 These tests will be carried out in beam line MT6 section 2B.

2.2 BEAM

2.2.1 BEAM TYPE and INTENSITY

Type of Beam Needed:	Proton
Intensity Needed:	1-10 KHz
Size of Beam needed:	1-10cm^2 (as small as achievable)

2.2.2 BEAM SHARING

The small size of the silicon sensors and other detectors used for the test should make moving the apparatus out of the way relatively easy if necessary.

2.3 EXPERIMENTAL CONDITIONS

2.3.1 SCHEDULE: The experimenters propose to use the test beam for 5-6 days in August 2008, with one day for equipment setup prior to running.

2.3.2 DETAILED DESCRIPTION OF TESTS:

The test setup will consist of 3 pixel ½ ladders forming a tracking telescope followed by 2-3 stripixel modules, along with readout electronics and trigger counters to provide a trigger for the both the pixel and stripixel readout systems. For the purpose of these tests, independent readout systems will be used for the pixel and stripixel systems. The pixel ½ ladders and stripixel sensor modules will be housed in a small environmental enclosure that will be provided by the experimenters.

The major steps in the test are as follows:

1. Setup pixel ½ ladders, stripixel sensor modules, trigger counters, and trigger and readout electronics.
2. Time in trigger with pixel and stripixel readout electronics.
3. Measure noise performance of pixel ½ ladders (threshold scans) and stripixel modules (pedestal measurements).
4. Measure pixel efficiency and charge sharing.
5. Measure stripixel efficiency and charge sharing.

III RESPONSIBILITIES BY INSTITUTION - NON FERMILAB (All PHENIX)

3.1 Scintillator detectors and power supplies for triggering.
3.2 NIM bins and NIM modules for trigger system.
3.3 Readout DAQ for pixel and stripixel systems.
3.4 Environmental enclosure for pixel and stripixel systems.
3.5 Silicon system will come with fiducials to facilitate alignment with test beam

IV. RESPONSIBILITIES BY INSTITUTION – FERMILAB

4.1 FERMILAB ACCELERATOR DIVISION:

4.1.1 Use of MTest beam as outlined in Section 2.

4.1.2 Maintenance of all existing standard beam line elements (SWICs, loss monitors, etc) instrumentation, controls, clock distribution, and power supplies.

4.1.3 Reasonable access to the experimenters' equipment in the test beam.

4.1.4 The test beam energy and beam line elements will be under the control of the AD Operations Department Main Control Room (MCR).

4.1.5 Position and focus of the beam on the experimental devices under test will be under control of MCR. Control of secondary devices that provide these functions will be delegated to the experimenters as long as it does not violate the Shielding Assessment or provide potential for significant equipment damage.

4.2 FERMILAB PARTICLE PHYSICS DIVISION

4.2.1 The test-beam efforts in this MOU will make use of the Meson Test Beam Facility. Requirements for the beam and user facilities are given in

Section 2. The Fermilab Particle Physics Division will be responsible for coordinating overall activities in the MTest beam-line, including use of the user beam-line controls and readout of the beam-line detectors.

4.2.2 The test beam facility shall provide a table or cart upon which the silicon environmental enclosure is mounted, with a total weight of ~100 lbs. The cart needs to provide vertical as well as horizontal motion to a precision of 1mm. The value of the position needs to be available.

4.2.3 The test beam facility shall provide a cooling system capable of cooling to -10^{o} C and removing 500W of heat.

4.2.4 The test beam facility shall provide a source of inert gas to flow through silicon environmental enclosure.

4.3 FERMILAB COMPUTING DIVISION

4.3.1 Ethernet connection to the Fermilab network should be available in the counting house.

4.3.2 Connection to beams control console and remote logging (ACNET) should be made available in the counting house.

4.3.3 Test beam facility DAQ computing support as needed during normal working hours.

4.4 FERMILAB ES&H SECTION

4.4.1 Assistance with safety reviews.

V. Summary of Costs

Source of Funds [$K]	Equipment	Operating	Personnel (person-weeks)
Particle Physics Division	$0 K	$0 K	0.5
Accelerator Division	0	0	0.5
Computing Division	0	0	0
Totals Fermilab	0 K	0	1.0
Totals Non-Fermilab	0K	0	6.0

VI. SPECIAL CONSIDERATIONS

6.1 The responsibilities of the spokesman of the PHENIX VTX group and procedures to be followed by experimenters are found in the Fermilab publication "Procedures for Experimenters": (http://www.fnal.gov/directorate/documents/index.html). The Physicist in charge agrees to those responsibilities and to follow the described procedures.

6.2 To carry out the experiment a number of Environmental, Safety and Health (ES&H) reviews are necessary. This includes creating an Operational Readiness Clearance document in conjunction with the standing Particle Physics Division committee. The spokesman of the PHENIX VTX group will follow those procedures in a timely manner, as well as any other requirements put forth by the division's safety officer and follow all procedures in the PPD Operating Manual.

6.3 The spokesman of the PHENIX VTX group will ensure that at least one person is present at the Meson Test Beam Facility whenever beam is delivered and that this person is knowledgeable about the experiment's hazards.

6.4 All regulations concerning radioactive sources will be followed. No radioactive sources will be carried onto the site or moved without the approval of the Fermilab ES&H section.

6.5 All items in the Fermilab Policy on Computing will be followed by the experimenters. (http://computing.fnal.gov/cd/policy/cpolicy.pdf).

6.6 The spokesman of the PHENIX VTX group will undertake to ensure that no PREP or computing equipment be transferred from the experiment to another use except with the approval of and through the mechanism provided by the Computing Division management. They also undertake to ensure that no modifications of PREP equipment take place without the knowledge and consent of the Computing Division management.

6.7 The PHENIX VTX group will be responsible for maintaining and repairing both the electronics and the computing hardware supplied by them for the experiment. Any items for which the experiment requests that Fermilab performs maintenance and repair should appear explicitly in this agreement.

6.8 At the completion of the experiment:

6.8.1 The spokesman of the PHENIX VTX group is responsible for the return of all PREP equipment, computing equipment and non-PREP data acquisition electronics. If the return is not completed after a period of one year after the end of running the spokesman of the group will be required to furnish, in writing, an explanation for any non-return.

6.8.2 The experimenters agree to remove their experimental equipment as the Laboratory requests them to. They agree to remove it expeditiously and in compliance with all ES&H requirements, including those related to transportation. All the expenses and personnel for the removal will be borne by the experimenters.

6.8.3 The experimenters will assist the Fermilab Divisions and Sections with the disposition of any articles left in the offices they occupied.

6.9 An experimenter will be available to report on the test beam effort at a Fermilab All Experimenters Meeting.

SIGNATURES:

_____ / / 2008
Yasuyuki Akiba, RIKEN

_____ / / 2008
Edward O'Brien, Brookhaven National Laboratory

_____ / / 2008
Greg Bock, Particle Physics Division

_____ / / 2008
Roger Dixon, Accelerator Division

_____ / / 2008
Victoria White, Computing Division

_____ / / 2008
William Griffing, ES&H Section

_____ / /2008
Stephen Holmes, Associate Director, Fermilab

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Young Kee Kim, Deputy Director, Fermilab

APPENDIX I - HAZARD IDENTIFICATION CHECKLIST

Items for which there is anticipated need have been checked

Cryogenics		**Electrical Equipment**		**Hazardous/Toxic Materials**	
	Beam line magnets		Cryo/Electrical devices		List hazardous/toxic materials
	Analysis magnets		capacitor banks		planned for use in a beam line or experimental enclosure:
	Target	**X**	high voltage		
	Bubble chamber		exposed equipment over 50 V		
Pressure Vessels		**Flammable Gases or Liquids**			
	inside diameter	Type:			
	operating pressure	Flow rate:			
	window material	Capacity:			
	window thickness	**Radioactive Sources**			
Vacuum Vessels			permanent installation	**Target Materials**	
	inside diameter		temporary use		Beryllium (Be)
	operating pressure	Type:			Lithium (Li)
	window material	Strength:			Mercury (Hg)
	window thickness	**Hazardous Chemicals**			Lead (Pb)
Lasers			Cyanide plating materials		Tungsten (W)
	Permanent installation		Scintillation Oil		Uranium (U)
	Temporary installation		PCBs		Other
	Calibration		Methane	**Mechanical Structures**	
	Alignment		TMAE		Lifting devices
type:			TEA	**X**	Motion controllers - manual
Wattage:			photographic developers		scaffolding/elevated platforms
class:			Other: Activated Water?		Others